AMENDMENTS

In the Specification:

Page 6, lines 1-6, amend the paragraph as follows:

The turbine and the control mechanism for the turbine will now be described in detail with reference to Figure 3. The impeller 241 of the turbine 240 is mounted about a drive shaft 245 within chamber 115. A set of bearings 246, 247 rotatably supports the drive shaft 245 at each of its ends. An air inlet 120 to the turbine is positioned at one end of the housing and an air outlet of the turbine is mounted at end 280. Airflow through the turbine is in a generally axial direction from left to right in Figure 3.

Page 6, line 26, to page 9, line 4, amend the paragraphs as follows:

The outermost surface of the button 200, between the inner 201 and outer 202 annular hubs, comprises a plurality of radial ribs 206, with the spaces between adjacent ribs defining air inlet apertures 205. The inlet apertures 205 are shielded by a finely graded mesh which serves to prevent dust from being carried into the turbine and fouling the mechanism. The passage between the outer annular hub 202 and diaphragm seal 210, and the inner annular hub 201, defines an airway 120 for the incoming airflow which drives the turbine 240. The circumference of the guide vane plate 230 supports a set of angled vanes 232. The angle of the vanes 232 serves to initiate a swirling flow of air around the housing which is matched to the angle of the blades on the turbine 240. The main airflow path through the turbine is shown by the arrows ~~adjacent secondary impeller~~ 244 ~~as described below~~. The turbine 240 shown here is an inward radial flow (IFR) turbine, which has been found to be well-suited to the pressure and flow rates in this application. However, it will be apparent that other types of turbine could be used, such as a Pelton Wheel.

There is also a secondary flow of air which plays an important part in operating the button 200 during an overspeed condition. The generally flat side of the turbine 240 (the left hand side of the impeller 241 ~~240~~ in Figure 3) has a plurality of depressions 242 defined in it,

separated by ribs 243. In use, these depressions 242 and ribs 243 act as a miniature impeller, which will hereafter be called a secondary impeller ~~244~~. Obviously, since the secondary impeller ~~244~~ is the rear face of the turbine 240, the two rotate at the same speed. The pumping effect of the secondary impeller ~~244~~ is proportional to the rotational speed of the turbine 240. This causes a region of low pressure between the guide vane plate 230 and turbine 240 ~~244~~. A plurality of axially directed apertures 234 in the supporting plate 230 join the region directly behind the turbine 240 ~~244~~ with the region inside the button 200. The region inside the button is effectively a chamber which is separated from the main airflow path, except for the restricted path through the apertures 234. The only other flow into region 216 is a small, inevitable, leakage between the inner annular hub 201 of button 200 and the part of the inlet cap 220 against which the button 200 slides. The size of the apertures 234 is a trade off between being sufficiently large so as to effectively communicate the pressure behind the secondary impeller ~~244~~ to the region 216 inside the button 200, and sufficiently small so that a large enough pressure difference is present in button 200 to enable a pumping effect to work. In use, the pumping action of the secondary impeller ~~244~~ reduces the pressure in region 216. The forces at work are shown in Figure 3. The spring 215 inside the button applies a force, labelled F_S, in an axially outward direction. There is also an axially directed force F_{PD} on the button 200 which results from the pressure difference between ambient pressure on the outside of button 200 (shown as the large inwardly directed arrow) and the pressure in region 216 inside the button 216. When the vacuum cleaner is switched off, the air in region 216 is also at ambient pressure and thus the only net force acting on the button is that due to the spring 215. However, when the vacuum cleaner is operating, the pressure in region 216 is less than ambient due to the partial evacuation of air from region 216 by the secondary impeller ~~244~~. This pressure difference causes an axially inwardly directed force acting on the button. When the impeller is rotating at normal speeds, i.e. around 25-30Krpm, the inwardly directed force F_{PD}, which is related to the pressure difference between ambient and the region inside the button 200, is

insufficient to overcome the axially outwardly-directed biasing force of the spring F_S. Thus, the button 200 remains in the open position and air continues to flow to the turbine 240 to operate the brush bar.

When the airflow path through the main inlet becomes blocked in some way, such as by an object becoming trapped in the ducting or by the suction inlet becoming sealed against a surface, an increased amount of air will flow through the air inlet 120 to the turbine 240. This increase in airflow will increase the speed of rotation of the turbine 240 and secondary impeller 244. Other faults, such as a breakage of the drive belt 260, can also cause an increase in the rotational speed of the turbine 240. When the speed of rotation increases to a predetermined level, the pumping action of the secondary impeller 244 causes a sufficient pressure difference between ambient and the region 216 inside the button 200, that the axially inwardly directed force on the button F_{PD} can overcome the outwardly directed biasing force of the spring, F_S. Thus, the button 200 moves into the closed position, as shown in Figure 4, and the diaphragm seal 210 presses against the inlet cap 220 to seal the inlet in an airtight manner. This prevents any air from reaching the turbine 240. As a result, the turbine 240 and the brush bar come to rest. Since the outlet side 280 of the turbine chamber continues to be in communication with the suction duct between the main suction inlet 111 on the tool and the main body 70 of the vacuum cleaner, which continues to be at low pressure, region 216 remains sufficiently evacuated to maintain the button 200 in the closed position. The speed of rotation which causes the button to move into the closed position is determined by factors which include the strength of the spring 215. We have found a maximum of speed of 45-50Krpm is an ideal limit, but this can, of course, be varied.

Page 10, lines 21-30, amend the paragraph as follows:

Button 320 can also act as an automatic bleed valve, i.e. the button 320 automatically moves into the open position in response to the flow of air along the passage 280. In a similar way to how the region inside button 200 (200') can be partially evacuated by the pumping effect

of the secondary impeller ~~244~~, the region inside button 320 is evacuated by the flow of air along passage 280. When button 320 is evacuated sufficiently, it moves into the open position and admits air into the region 280 downstream of the turbine. This has the effect of slowing down the turbine 240. Of course, if the amount of air which is bled into the region 280 by button 320 is insufficient to prevent the turbine 240 from overspeeding, the button 200' will close to seal off the air inlet to the turbine.

Page 11, lines 13-22, amend the paragraph as follows:

From the above, it will be clear that button 200 can automatically move into a closed position and seal the air inlet to the turbine when the turbine rotates too quickly. Another useful feature of this arrangement is that a user can manually press the button 200 into the closed position should they wish to turn off the brush bar, e.g. when cleaning hard floors or delicate surfaces. To manually turn off the brush bar, a user simply pushes button 200, against the bias of spring 215, and momentarily holds the button 200 in the closed position. Pushing the button 200 evacuates region 216 inside the button 200 in the same manner achieved by the secondary impeller ~~244~~ during an overspeed condition. The brush bar can be turned on again in the same manner as previously described.

Page 14, lines 11-20, amend the paragraph as follows:

The preferred way of operating the button 200 is to provide a secondary impeller 244 on the rear face of the turbine 240. Depressions 242 and ribs 243 form this secondary impeller. However, the following alternative schemes are also possible, and are intended to be included in the scope of the invention. Instead of using the rear face of ~~impeller~~ the turbine 240, a second, dedicated, impeller could be mounted on the drive shaft 245 at a position which is axially offset from the main impeller 241 of turbine 240. Obviously, this would increase the cost and size of the tool. As a further alternative, the rear face of the turbine 240 could be flat, rather than having depressions 242 and ribs 243. As a still further alternative, the means for evacuating the region 216 inside the button can be a venturi in the main airflow path to or from the turbine.